

Service Manual for Volumetric Pump

green stream[®] VO-P

ARGUS 414

Made in Switzerland

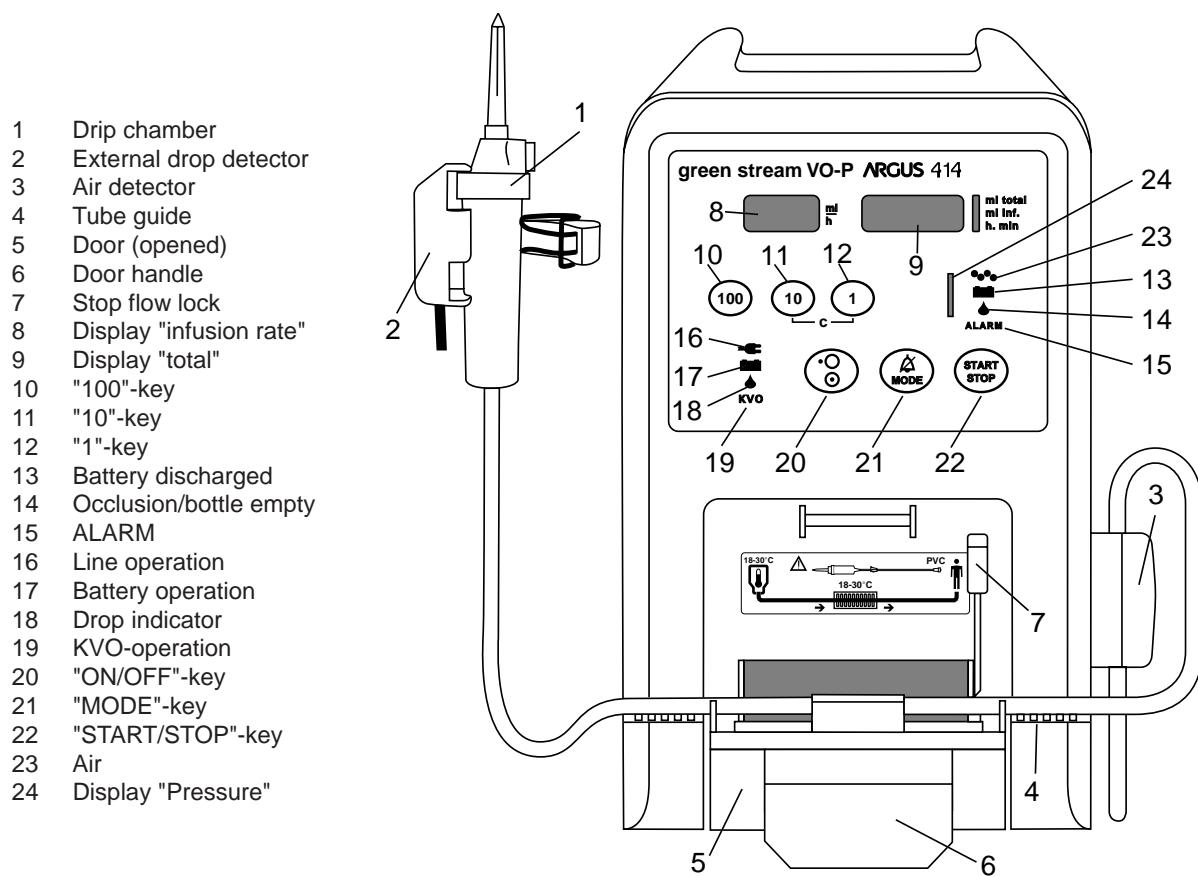
CE 0120

IMPORTANT

This service manual is intended for the exclusive use of authorized persons who have been trained by ARGUS Medical AG in the maintenance and repair of the infusion apparatus mentioned above.

ARGUS Medical AG shall not assume any responsibility for any manipulations which have been carried out on the unit by a non-authorized person.

ARGUS Medical AG, CH-3627 Heimberg/Switzerland
(A member of the CODAN group)



- 1 Drip chamber
- 2 External drop detector
- 3 Air detector
- 4 Tube guide
- 5 Door (opened)
- 6 Door handle
- 7 Stop flow lock
- 8 Display "infusion rate"
- 9 Display "total"
- 10 "100"-key
- 11 "10"-key
- 12 "1"-key
- 13 Battery discharged
- 14 Occlusion/bottle empty
- 15 ALARM
- 16 Line operation
- 17 Battery operation
- 18 Drop indicator
- 19 KVO-operation
- 20 "ON/OFF"-key
- 21 "MODE"-key
- 22 "START/STOP"-key
- 23 Air
- 24 Display "Pressure"

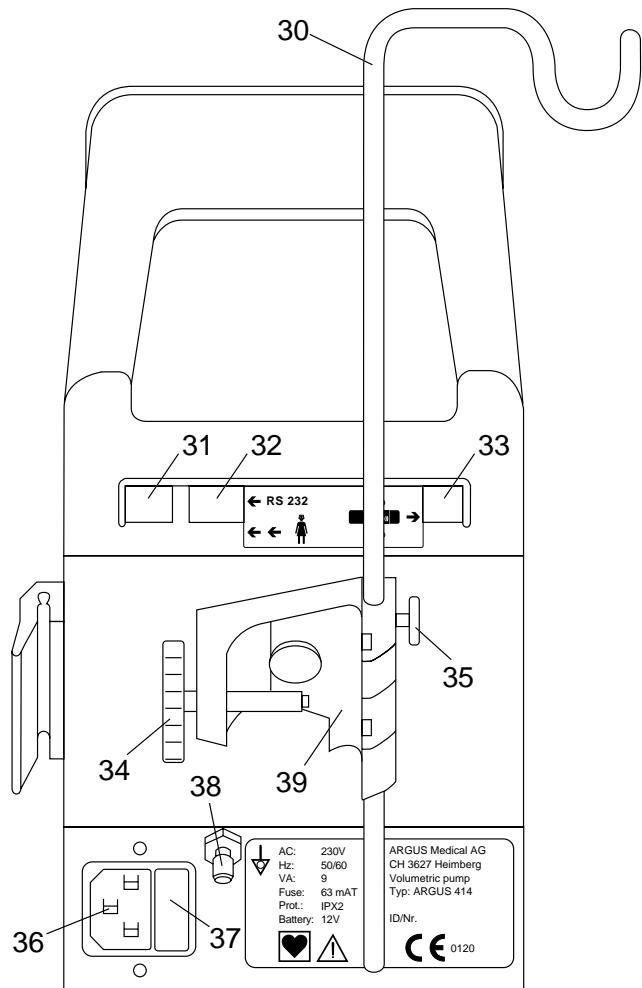


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1 Special key inputs and configurations

1.1 Special key inputs:

Configuration

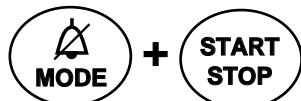
CAUTION! The configuration possibilities mentioned below constitute a modification of the pump and may only be carried out by authorized persons.

If the decimal points are flashing in a display, this display is ready to accept an input by means of the keys "100, 10, 1".

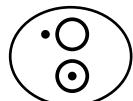
Input of the address in display (2)

Input of the values in display (3)

a Interrogation mode



Hold both keys pressed



Important!

Do not release the keys "MODE" and "START/STOP"



Enter the requested address (eg. 52).



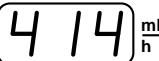
The programmed data of address 52 are displayed

Press the key at least 2 seconds.

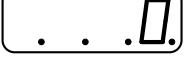
1.2 Configuration mode without PIN code

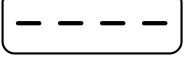
 +  Hold both keys pressed

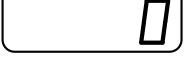
 Important!
Do not release the keys "MODE" and "START/STOP"

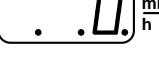
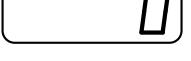
 

   ml total
ml inf.
h. min

   ml total
ml inf.
h. min

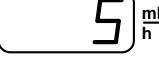
   ml total
ml inf.
h. min

   ml total
ml inf.
h. min

   ml total
ml inf.
h. min

   Enter the requested address (eg. 5).

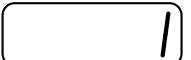
  ml total
ml inf.
h. min

   ml total
ml inf.
h. min

   Enter the requested data (eg. 1).

  ml total
ml inf.
h. min

 If the data are accepted, entry changes to the left display.

  ml total
ml inf.
h. min



1.3 Programming mode: first input of write protection (code)

IMPORTANT ! Remember to make a note of your code and keep it in a safe place.

Key	Description	Display (8)	Display (9)
1 "MODE" & "START/STOP"	Keep both keys pressed before switching the unit on.	"414"	"prog"
2 "START/STOP"	Acknowledgement (write protection is inactive)	". . 0."	" 0"
3 "MODE"	Switch over to display (9)	" 0"	". . 0."
4 "START/STOP"	Acknowledgement	"Cod"	"- - - "
5 "MODE"	Switch over to display (9)	"Cod"	" 0"
6 "START/STOP"	Acknowledgement	". . 0."	" 0"
7 "MODE"	Switch over to display (9)	" 0"	". . 0."
8 "100;10;1"	Enter 1 to 4 digit code	" 0"	" C.C.C.C."
9 "START/STOP"	Acknowledgement (write protection is active) Code is never visible	". . 0."	" 1"
10 "ON/OFF"	End of programming mode		

1.4 Programming mode with active write protection (code)

CAUTION! Only the code holder can carry out modifications when the write protection is active.

Key	Description	Display (8)	Display (9)
1 "MODE" & "START/STOP"	Keep both keys pressed before switching the unit on.	"414"	"prog"
2 "START/STOP"	Acknowledgement (write protection is active)	". . 0."	" 1"
3 "MODE"	Switch over to display (9)	" 0"	". . 1."
4 "START/STOP"	Acknowledgement	"Cod"	"- - - "
5 "100;10;1"	Enter code	"Cod"	" X X X X "
6 "START/STOP"	Acknowledgement	". . 0."	" 1"
7 "100;10;1"	Enter requested address Programmed data appear in display (9)	"A.A.A."	"X X X X "
8 "MODE"	Switch over to display (9)	" AAA"	" X.X.X.X."
9 "100;10;1"	Enter requested data	"AAA"	" Y.Y.Y.Y."
10 "START/STOP"	Acknowledgement.If the data are accepted, entry changes to display (8)	"A.A.A."	" Y Y Y Y "
11 "ON/OFF"	End of programming mode		

1.5 List of the interrogation- and configuration functions:

CAUTION! Before you make a new configuration or replace an EPROM or the mainboard make a note of the programmed values. Afterwards you can re-enter the old not writeprotected values.

Address (#)	Write prot.	Default Value	Function	
0	0 = No	PIN code active		
1	1 = Yes	Run indication by running decimal point		
2	0 = No	Key "ON/OFF" only at STOP valid		
3	0 = No	Rate change only at STOP valid		
4	0 = No	Key "STOP" delayed (time at #361)		
5	0 = No	2nd entry of rate (#3=1), rate calculation disabled.		
6	0 = No	Static alarm (staff alerting system)		
7	0 = No	Display elapsed time in run mode (#8=0)		****
8	0 = No	Select remaining time (#7=1)		
9	1 = Yes	Alternative time input (10h, 1h, 1/4h)		
10	0 = No	Operation without drop detector		
11	1 = Yes	Recall "ml/h" (rate) at next power on		
12	0 = No	Recall "ml total" (end volume) at next power on		
13	0 = No	Recall "ml inf." (volume inf.) at next power on		
14	0 = No	SBS Step By Step function		
15	0 = No	Display VTBI (Volume To Be Infused)		
16	0 = No	Display "SEt -X-" if only 1 set enabled		
17	1 = Yes	KVO (KOR), mode see #60		
18	0 = No	Drop alarm only if bottle is empty (#10=0)		
19	1 = Yes	Buzzer at start		
20	0 = No	Menu "CLr" (clear "ml inf.") (#15=0)		****
21	0 = No	Menu "uOP" (Micro operation)		****
22	0 = No	Menu "trA" (transport) (#10=0 and #18=0)		****
23	1 = Yes	Menu "PrL" (pressure alarm limit)		****
24	1 = Yes	Menu "CAP" (battery capacity)		****
25	0 = No	Menu "SEt Fill"		****
26	0 = No	Menu "InF" ("ml inf." since last power on)		****
27	0 = No	Menu "dLo" (data-lock)		****
28	0 = No	Menu "Stb" (stand-by)		****
29	0 = No	Menu "MEd" (medication number)		****
30	0 = No	Menu "tM " (timer alarm)		****
31	0 = No			
32	0 = No	Menu "boL" (release bolus)		****
33	0 = No	Menu "boLr" (bolus rate) (#32=1)		****
34	0 = No	Menu "tot" (bolus total) (#32=1)		****
35	0 = No			
36	0 = No			
37	0 = No			
38	0 = No	Bolus application automatic (#32=1 and #34=1)		
39	0 = No			
40	0 = No	Demo mode (all menus enabled)		****
41	0 = No	Clear "ml/h" after infusion completed		
42	0 = No	Clear "ml total" after infusion completed (#41=1)		
43	0 = No	Air volume accumulated (1ml over 0.5 hrs)		
44	1 = Yes	Automatic pressure release after occlusion		
45	1 = Yes	Pressure display 20/40/60/80/100% (Bargraph ON)		
46	0 = No	Bargraph with indicator (25% steps, #45=1)		
47	0 = No	Standby- and battery prealarm low volume		
48	1 = Yes	Flashing numeric display at alarm		
49	0 = No	Alarm acknowledge only with key "MODE"		

Address	Write	Default	Function
(#)	prot.	Value	
50		0 = No	Start with ≥ 1 bar allowed
51		1 = Yes	Start without infusion set
52		1 = Yes	High resolution if calculated rate < 100 ml/h
53		0 = No	Micro mode after power on as default (Clear = 0.0 ml/h)
54		0 = No	
55		0 = No	
56		0 = No	
57		0 = No	
58		0 = No	
59		0 = No	
60		0 = No	KVO only after infusion completed
61		0 = No	
62		0 = No	
63		0 = No	
64		0 = No	
65		0 = No	Clear and continue (#15=0)
66		0 = No	
67		0 = No	
68		0 = No	
69		0 = No	
100		0 = No	
101		1 = Yes	Set 1 enabled
102		0 = No	Set 2 enabled (Pressure sensor and volume calibration requested)
103		0 = No	Set 3 enabled (Pressure sensor and volume calibration requested)
104		0 = No	Set 4 enabled (Pressure sensor and volume calibration requested)
105		0 = No	
106		0 = No	
107		0 = No	
108		0 = No	
109		0 = No	
200		0 = No	
201		0 = No	
202		0 = No	
203		0 = No	
204		0 = No	
205		0 = No	
206		0 = No	
207		0 = No	
208		0 = No	
209		0 = No	Set 1 definition
210		0 = No	
211		0 = No	
212		0 = No	
213		0 = No	
214		0 = No	
215		0 = No	
216		0 = No	
217		0 = No	
218		0 = No	
219		0 = No	

Address	Write	Default	Function
(#)	prot.	Value	
220		0 = No	
221		0 = No	
222		0 = No	
223		0 = No	
224		0 = No	
225		0 = No	
226		0 = No	
227		0 = No	
228		0 = No	
229		0 = No	Set 2 definition
230		0 = No	
231		0 = No	
232		0 = No	
233		0 = No	
234		0 = No	
235		0 = No	
236		0 = No	
237		0 = No	
238		0 = No	
239		0 = No	
240		0 = No	
241		0 = No	
242		0 = No	
243		0 = No	
244		0 = No	
245		0 = No	
246		0 = No	
247		0 = No	
248		0 = No	
249		0 = No	Set 3 definition
250		0 = No	
251		0 = No	
252		0 = No	
253		0 = No	
254		0 = No	
255		0 = No	
256		0 = No	
257		0 = No	
258		0 = No	
259		0 = No	
260		0 = No	
261		0 = No	
262		0 = No	
263		0 = No	
264		0 = No	
265		0 = No	
266		0 = No	
267		0 = No	
268		0 = No	
269		0 = No	Set 4 definition

Address	Write	Default	Function
(#)	prot.	Value	
270		0 = No	Set 4 definition
271		0 = No	
272		0 = No	
273		0 = No	
274		0 = No	
275		0 = No	
276		0 = No	
277		0 = No	
278		0 = No	
279		0 = No	
300		0	
301		0	
302		0	
303		0	
304		0	
305		0	
306	X	0	Infused sum in ml (xxxxyyyy) [xxxx . . . ml]
307	X	0	Infused sum in ml (xxxxyyyy) [. . . yyyy ml]
308	X	0	Operating time in min (xxxxyyyy) [xxxx . . . min]
309	X	0	Operating time in min (xxxxyyyy) [. . . yyyy min]
310	IV set -1-	999	Max. rate in ml/h (1...999 ml/h)
311		999	Prime rate in ml/h (1...999 ml/h)
312		999	Max. bolus rate in ml/h (1...999 ml/h)
313		10	Max. bolus total in ml (1...99 ml)
314		0	
315		4	Pressure limit "PrL" default value micro mode (1..10 * 100 mbar)
316		7	Pressure limit "PrL" default value (1..10 * 100 mbar)
317		250	Airbubble size (50...1000 µl)
318		20	Drop-rate window centre in drops/ml (10...65)
319		1000	Correction (850...1150) ((actual/nominal)*1000)
320	IV set -2-	999	Max. rate in ml/h (1...999 ml/h)
321		999	Prime rate in ml/h (1...999 ml/h)
322		999	Max. bolus rate in ml/h (1...999 ml/h)
323		10	Max. bolus total in ml (1...99 ml)
324		0	
325		4	Pressure limit "PrL" default value micro mode (1..10 * 100 mbar)
326		7	Pressure limit "PrL" default value (1..10 * 100 mbar)
327		250	Airbubble size (50...1000 µl)
328		20	Drop-rate window centre in drops/ml (10...65)
329		1000	Correction (850...1150) ((actual/nominal)*1000)
330	IV set -3-	999	Max. rate in ml/h (1...999 ml/h)
331		999	Prime rate in ml/h (1...999 ml/h)
332		999	Max. bolus rate in ml/h (1...999 ml/h)
333		10	Max. bolus total in ml (1...99 ml)
334		0	
335		4	Pressure limit "PrL" default value micro mode (1..10 * 100 mbar)
336		7	Pressure limit "PrL" default value (1..10 * 100 mbar)
337		250	Airbubble size (50...1000 µl)
338		20	Drop-rate window centre in drops/ml (10...65)
339		1000	Correction (850...1150) ((actual/nominal)*1000)

Address	Write	Default	Function
(#)	prot.	Value	
340		999	Max. rate in ml/h (1...999 ml/h)
341		999	Prime rate in ml/h (1...999 ml/h)
342		999	Max. bolus rate in ml/h (1...999 ml/h)
343	4-	10	Max. bolus total in ml (1...99 ml)
344		0	
345	IV	4	Pressure limit "PrL" default value micro mode
346		7	Pressure limit "PrL" default value
347		250	Airbubble size (50...1000 µl)
348		20	Drop-rate window centre in drops/ml (10...65)
349		1000	Correction (850...1150) ((actual/nominal)*1000)
360		0	
361		500	Key "ON/OFF" delay (0...3000 msec), (additional key "STOP"] if #4=1)
362		3	Display brightness (1...3)
363		10	Buzzer alarm volume (5...10)
364		0	
365		0	
366		0	
367		0	
368		270	Battery discharge time incl. 15 min prealarm (45...615 min)
369		5	Automatic menu fall back delay time
			(5...30 s)
370		0	Clock seconds
371		0	Clock minutes
372		0	Clock hours
373		0	
374		0	Clock days
375		0	Clock months
376		0	Clock years
377		0	
378		0	
379		0	
380	X		Last failure number (F-XX)
381	X		Last infusion rate at failure
382	X		2. last failure number (F-XX)
383	X		2. last infusion rate at failure
384	X		3. last failure number (F-XX)
385	X		3. last infusion rate at failure
386	X		4. last failure number (F-XX)
387	X		4. last infusion rate at failure
388	X		5. last failure number (F-XX)
389	X		5. last infusion rate at failure
390		0	Last service date (yyww, year and week)
391	X	0	2. last service date
392	X	0	3. last service date
393		0	Service interval in months (1..24, 0 = disabled)
394		0	Service interval in hours (1..9999, 0 = disabled)
395		0	Own address for SCI (0=no address, or 1...127)
396		0	Inventory-no. of the pump (xxxx yyyy)
397		0	Inventory-no. of the pump (xxxx yyyy)
398		0	
399	X	414	Data xxxx -> clears protection key

1.6 Special configuration options

- Configuration of a reminder alarm for the safety standard check:

First the service interval has to be configured either in months or in hours of operation, or both (addresses 393, 394).

Next the last service date has to be entered on address 390. Any value higher than 0 entered at the addresses 393 and/or 394 will release the reminder alarm after the set service interval has elapsed (check also the correct settings of the internal clock).

- PC configuration tool "AConfig":

With this additional software the pump may be configured from a PC over the serial port. This software may be available from your local distributor or our service department.

- IV-set definition:

Allows the individual calibration of up to 4 dedicated IV-sets over the full infusion rate range. Please contact your local distributor or our service department for further information.

After changing the configuration a function check and a control measurement has to be made!

2 History and pump configuration printout

2.1 Connecting of the ARGUS414 to the serial interface

Caution: The infusion pump must be disconnected from the patient before any connection over the serial interface can be done.

A connection of the ARGUS414 to a computer is useful to the read the actual configuration or history of the pump. Even a simple monitoring of the pump can be done over the serial interface RS-232.

The connection of the infusion pump with your computer over the interface can be done by connecting the interface cable and adapter (part 12.011 and part 12.012) and the following steps:

- Connect the RS-232 interface cable to outlet (32) of the infusion pump and to the serial port of your PC. Note in which port (COM1 or COM2) you have plugged in.
- Start your terminal program on your computer. A simple terminal program, e.g. "Hyper Terminal" is included in every MS-Windows 9x and Windows NT systems, but must be installed first if necessary.
- Be sure that you have selected the right serial port (COM1 or COM2) and set the following communication parameters:

Bits per second: 4800 Baud

Data bits: 8 bits

Parity: None

Stop bits: 1 bit

Protocol: None

- Go to the next step in one of the further chapters, depending on your intention.

2.2 Configuration printout

- Switch the pump on while keeping the keys "MODE" and "START/STOP" pressed and go in the configuration mode.
- Select address **399** on the left hand display.
- Start capturing text received over the serial interface, e.g. by selecting "capturing text..." in the menu of the Hyper terminal. A text file which contains the actual configuration printout will now be generated.
- Enter the data **3456** on the right display of the pump.
- Press the "START/STOP" key.
- The pump will now transfer the actual configuration of the pump in the format mentioned below.
- Stop the capturing of the text received; this will also close the text file generated.
- The generated text file can be opened and printed out by any text program.

Pump configuration printout (sample)

/***** Configuration profile ***** / Wed 19-Jan-2002 11:29:55

Pump type	:	ARGUS414					
Inventory number	:	0000 0000					
Software release	:	v1.00 (000719-4061)					
Infused sum	:	678ml					
Operating time	:	5h32min					
Last service date	:	2000 week 12					
00=0	50=0	100=0	300=0	320=0400	340=0000	360=0000	380=0000
01=1	51=0	101=0	301=0	321=0000	341=0000	361=0000	381=0000
02=0	52=0	102=0	302=0	322=0000	342=0000	362=0000	382=0000
03=0	53=1	103=1	303=0	323=0000	343=0000	363=0000	383=0000
etc.							

2.3 History printout

The transfer of the last events made on the pump can be done either by this way:

- Switch the pump on while keeping the key "100" pressed.

Or by this way:

- Switch the pump on while keeping the keys "MODE" and "START/STOP" pressed and go in the configuration mode.
- Select address **399** on the left display of the pump.
- Start capturing text received over the serial interface, e.g. by selecting "capturing text..." in the menu of the Hyper terminal. A text file which contains the history printout will now be generated.
- Enter the data **4567** on the right display of the pump.
- Press the "START/STOP" key.
- The pump will now transfer the last events made on the pump in the format mentioned below.
- Stop the capturing of the text received; this will also close the text file generated.
- The generated text file can be opened and printed out by any text program.

History printout (sample)

```
/***** History *****/      Mon 28-Aug-2000 08:42:44

Pump off                      Mon 28-Aug-2000 11:54:38
Rate   = 123.0ml/h           IV-Set   = 3
Total  = 0050.0ml            PrLimit = 0500mbar
Infsum = 0054.0ml           Status   = 0x0000

Pump on                       Mon 28-Aug-2000 15:01:58
Rate   = 010.0ml/h           IV-Set   = 3
Total  = 0050.0ml            PrLimit = 0500mbar
Infsum = 0009.0ml           Status   = 0x0000
etc.
```

The possible messages are:

Battery defective	PC configuration done	Too many drops, pump stop
Battery low prealarm	Pump has detected failure	Inf-set change
Battery low, pump stop	Pump off	Timer alarm, pump stop (KVO)
Bolus start	Pump on	Total volume reached, pump stop (KVO)
Bolus stop	Pump start	Datalock off
External power off	Pump stop (KVO)	Datalock on
External power on	Rate change	Infsum cleared
Bolus total reached	Enter setup mode	No drops, pump stop
Occlusion, pump stop	Exit setup mode	Not enough drops, pump stop
PrLimit change	Transport off	Door open, pump stop
PC configuration failure	Transport on	Air bubble, pump stop

2.4 Monitoring of the ARGUS414

Caution: The monitoring of the infusion pump ARGUS414 over the serial interface of a PC is only for demonstration purposes; any connection with patients has not been tested under the conditions of EN 60601-1 and are not allowed.

- Switch the pump on with an inserted filled infusion set.
- Enter one of the following command directly in your terminal window or transmit the corresponding ASCII code over your own monitoring program. A short sample of a monitoring session is mentioned at the end of this chapter.

Command	Keystrokes in terminal	ASCII code	Description
ENQ	Ctrl+E	05H	Request status (see format below)
SO	Ctrl+N	0EH	Sets pump in remote mode
STX	Ctrl+B	02H	Start of data entry (see format below)*
'data'	Data	-	Data*
ETX	Ctrl+C	03H	End of data entry*
DC2	Ctrl+R	12H	Start infusion*
DC4	Ctrl+T	14H	Stop infusion*
SI	Ctrl+O	0FH	Sets pump in local mode
ACK	Ctrl+F	06H	Alarm suppression (2min)*
FS	Ctrl+\	1CH	Enables/disables KVO*
BEL	Ctrl+G	07H	Toggle "Buzzer at start mode"*
CAN	Ctrl+X	18H	No start tests at next start*
ESC	Ctrl+[1BH	Next character following ESC ("Ctrl+[") will select the pump with address "addr", if more than one is connected to the serial interface
"addr"	-	0-127	Address (must be the same as in the pump configuration on address 395)* * Only valid in remote mode

Format of "data" entry: **STX 0 1 2 0 0 2 0 0 0 0 1 0 7 0 0 0 0 A B C D E ETX**

Rate 1E2	Rate 1E1	Rate 1E0	Rate 1E-1	Total 1E3	Total 1E2	Total 1E1	Rate 1E2	Rate 1E1	Rate 1E0	Rate 1E-1	Total 1E3	Total 1E2	Total 1E1	Total 1E0
----------	----------	----------	-----------	-----------	-----------	-----------	----------	----------	----------	-----------	-----------	-----------	-----------	-----------

Format of "status", which will be returned by the pump after typing "Ctrl+E" in the terminal:

STX 0 1 2 0 0 2 0 0 0 0 0 1 0 7 0 0 0 0 A B C D E ETX	Rate 1E2	Rate 1E1	Rate 1E0	Rate 1E-1	Total 1E3	Total 1E2	Total 1E1	Rate 1E2	Rate 1E1	Rate 1E0	Rate 1E-1	Total 1E3	Total 1E2	Total 1E1	Total 1E0
	Medicament 1E1	Medicament 1E0	Statusbyte-1	Statusbyte-2	Statusbyte-3	Statusbyte-4	Statusbyte-5	PrL 1E3	PrL 1E2	PrL 1E1	PrL 1E0	Medicament 1E1	Medicament 1E0	Statusbyte-1	Statusbyte-2

Format statusbyte-1:

P	Parity	<input checked="" type="checkbox"/>
1	Always high	<input checked="" type="checkbox"/>
X	Pump type (0 = A414)	<input checked="" type="checkbox"/>
X	Reserved	<input checked="" type="checkbox"/>
X	Battery active	<input checked="" type="checkbox"/>
X	Battery low prealarm	<input checked="" type="checkbox"/>
X	Battery low, pump stop	<input checked="" type="checkbox"/>
X	Battery defective	<input checked="" type="checkbox"/>

Format statusbyte-2:

P	Party	1	X	X	X	X	X
	Always high			Reserved		Reserved	
		Occlusion, pump stop					
			Reserved				
				Occlusion, pump stop			
					Bottle empty, pump stop		
						Airbubble, pump stop	

Format statusbyte-3:

Parity	P
Always high	1
Remote mode active	X
Reserved	X
Global Alarm	X
Door open	X
Pump stop (KVO)	X
KVO active	X

Format statusbyte-4:

P	Parity	1	X	X	X	X	X
Always high							
Reserved							
Bolus active							
Data lock active							
Time reached, pump stop (KVO)							
Timer alarm, pump stop (KVO)							
Standby alarm active							

Format statusbyte-5:

P	Parity	1	X	X	X	X	X	X
	Always high							
	Pressure indicator (adress 46)							
	Bargraph-LED upper							
	Bargraph-LED lower+3							
	Bargraph-LED lower+2							
	Bargraph-LED lower+1							
	Bargraph-LED lower							

A sample of a monitoring session:

- Switch the pump on with an inserted filled infusion set.
- Type "Ctrl+N" to set the pump in remote mode.
- Type "Ctrl+B", then "01200200" and then "Ctrl+C" which sets the rate to 12.0 ml/h and an infusion total of 200 ml. The rate should now be shown in the left display of the pump.
- Type "Ctrl+R" to start the infusion.
- Type "Ctrl+T" to stop the infusion.

3 Fault finding

The fault code in case of a failure is displayed by pressing "MODE" key (21). (F-XX) appears in display (9), and the source of the failure is listed in the table below:

Error	Error reason	Assembly group
F-21...22	ROM test	Mainboard
F-23...24	RAM test	Mainboard
F-25	CPU test	Mainboard
F-26	Invalid function menu	
F-27	EEPROM data invalid	Mainboard
F-28	RTC (real time clock) data invalid	Mainboard
F-29	Stepper motor power test	Mainboard
F-31	1.2 Volt supply out of range	Mainboard
F-32	5 Volt supply out of range	Mainboard
F-33	30 Volt supply out of range	Mainboard
F-41	Pressure sensor test failed	Pressure sensor or mainboard
F-42	Air detector test failed	Air detector or mainboard
F-43	Air bubble size invalid	Mainboard
F-44...45	Address invalid for EEPROM	Mainboard
F-46	Frequency from µC or RTC out of range	Mainboard
F-47	Displayboard not present	
F-48	Key(s) too long active	Displayboard
F-49	Set correction invalid	Mainboard
F-50	Pressure monitor	Mainboard or pressure sensor
F-51...56	Rotation control	- Mainboard - Hallboard - Motor - Clutch
F-57...59	Volume control	Mainboard

Exceptionally a fault code may appear, which is not included in this list. In this case we recommend to change the main board.

4 Replacement of parts

4.1 Disassembly of the pump

NOTE: The exploded views in the appendix show the individual mounting steps.

CAUTION!

Switch the unit off and disconnect the mains cable from the power outlet before opening the housing. The antistatic protection have to be strictly adhered to when the ARGUS infusion pump is disassembled (the use of an antistatic table mat and a grounded clip are recommended, for example).

a Disassembly of the hood:

Remove the four screws on the side and on the rear wall, lift hood up and disconnect the plug-type connector of the drop barrier.

b Disassembly of the main printed board assembly:

Disconnect the plug-type connector of the main printed board assembly and unscrew the two lateral attachment screws. Please refer to the wiring diagram in the appendix.

c Disassembly of the front panel:

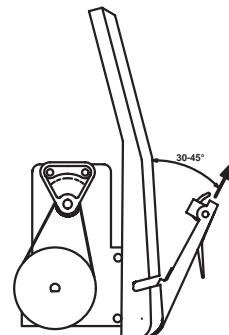
Use a ball-headed hexagon screwdriver to unscrew the two attachment screws from the rear and remove the front panel. This special screwdriver can be obtained from the service department on request.

d Disassembly of the pump unit:

By unscrewing the four attachment screws, the whole pump unit can be removed from the front panel.

e Remove the pump door:

The pump door can be remove without any tools by pulling it out in the direction of the arrow according to the drawing. For the dismantling and the mounting the opening angle from 30 to 45° has to be kept.



4.2 Replacement of the EPROM or the display board

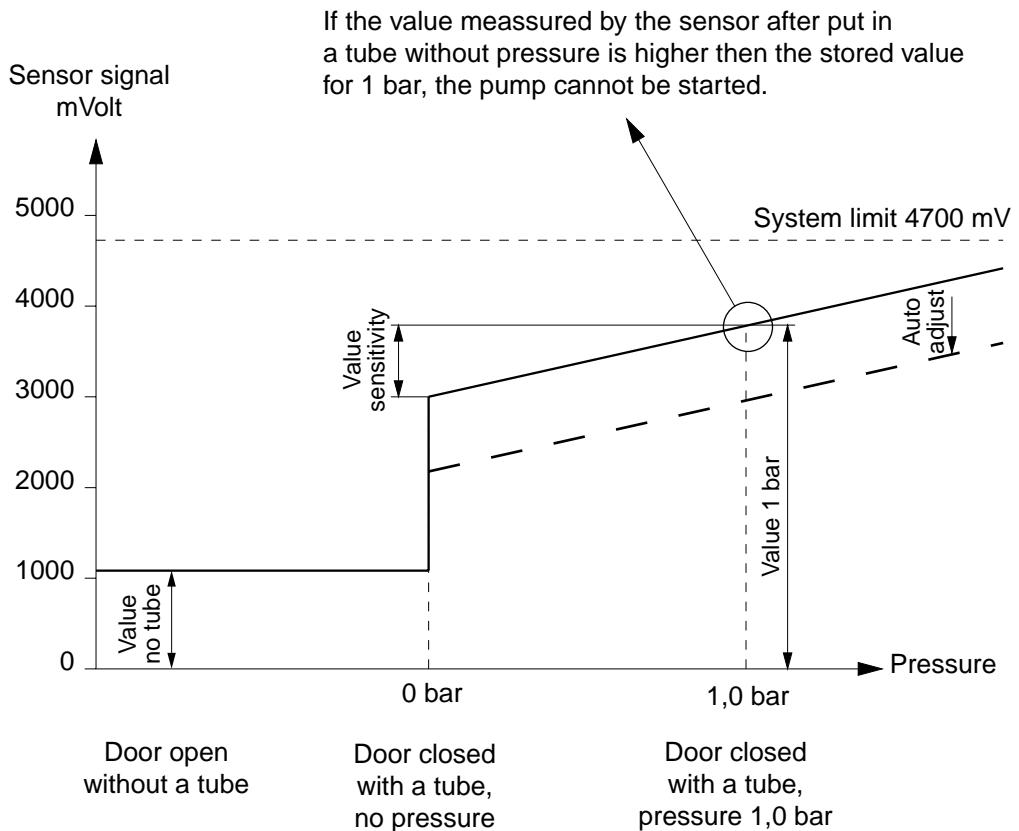
a Software updates may reset automatically the default values in the EEPROM. You are requested to write down the actual contents of the addresses before you replace the EPROM or the display board. Afterwards you have to re-enter these values in the program mode. If a write protection code has been used before, the same code has to be programmed again.

b A pressure sensor calibrating is necessary when replacing the pressure sensor, a pressure sensor calibration and a volume calibration are necessary when replacing the EPROM or the display board. Be careful and carry out the described instructions step by step.

4.3 Pressure sensor calibration

- 1 Go to the program mode (without IV-administration set).
- 2 Enter in address **399** the value **1234**.
- 3 Press the key "START/STOP"
The display shows e.g. **[Set] [-2-]**. Choose the IV set (no. 1 to 4) by pressing the key [1].
- 4 Press the key "START/STOP" (The pump mechanic runs with a rate of ca. 200 ml/h).
The display shows **[CAL.] [door]**. By pressing the key "1" it is possible to show the stored value in mV in the display.
- 5 Press the key "START/STOP". The offset voltage, without IV-set, will be stored.
The stored value will be acknowledged by a sound.
- 6 Press the key "MODE".
The display shows **[CAL.] [0bAr]**. By pressing the key "1" it is possible to show the stored value in mV in the display.
- 7 Install an used (milled) IV-administration set (Open the roller clamp).
- 8 Start the pressure build-up by occluding the tube on the patient side to control the mechanical pressure limit.
Minimum 1.2 bar has to be reached for a successful calibration.
- 9 Gradually decrease the pressure by removing the occlusion.
- 10 Wait ca. 30 sec., then activate the key "START/STOP". The reference value for sensitivity calculation will be stored. The stored value will be acknowledged by a sound.
- 11 Press the key "MODE".
The display shows **[CAL.] [1bAr]**. By pressing the key "1" it is possible to show the stored value in mV in the display.
- 12 Start the pressure build-up again, wait until the manometer shows 1 bar, then activate the key "START/STOP". The absolute value at 1 bar will be stored. The stored value will be acknowledged by a sound.
- 13 Gradually decrease the pressure.
- 14 Turn the pump off- and on again.
- 15 Select the rate at 500 ml/h.
- 16 Press the key "START/STOP".
- 17 Start the pressure build-up to control the electronic pressure limit.
- 18 The alarm must be activated at ca. 700 mbar \pm 100 mbar if the default value = "7".
If the result is not satisfactory repeat the sensor calibration.
- 19 Switch the pump off.

4.4 Pressure sensor signal



4.5 Volume calibration general

- 1 Go into the program mode.
- 2 Decide which IV set should be calibrate and check its release address.
 - address 101 for IV set no. -1-
 - address 102 for IV set no. -2-
 - address 103 for IV set no. -3-
 - address 104 for IV set no. -4-

Set the correction value in one of the following address to **1000**:

- address 319 for IV set no. -1-
- address 329 for IV set no. -2-
- address 339 for IV set no. -3-
- address 349 for IV set no. -4-

Switch the pump off and on.

- 3 Select the IV set you like to calibrate and make the following pump settings (for warm up the peristaltic system): Rate = 999 ml/h; volume "total" = 10 ml
Start the pump by pressing "START/STOP" once. Switch the pump off and on again after the volume "total" is reached.
- 4 The next pump settings are:
Rate = 100 ml/h; volume "total" = 25 ml
Start the pump by pressing "START/STOP" once. Switch the pump off immediately after the volume "total" is reached, the net weight result must be 25 g +/-5%.
- 5 Calculate the correction factor with the equation:
Correction factor = (measured volume / preset volume) * 1000
- 6 Go into the program mode and select address for the correction value (see point 1)
Press "MODE" to enter the correction factor in the right hand display.
Press "START/STOP"] to acknowledge the correction factor.
Switch the pump off.
- 7 Make a control measurement with the same settings as mentioned in point 4, using the IV-set for which the correction factor has been changed. Perform an occlusion pressure check (see chapter "Pressure sensor calibrating", point 15-19) to verify the pressure alarm level.

4.6 Volume calibration by the integrated program

- 1 Go to the program mode.
- 2 Enter in address 399 the value 123.
- 3 Press the key "START/STOP".
The display shows e.g. [Set] [-2-]. Choose the IV set (no. 1 to 4) by pressing the key [1].
- 4 Press the key "START/STOP".
The display shows [bAL.] [tArA]. The right hand display is flashing.
The pump delivers a volume of 5 ml by a rate of 250 ml/h to warm up the tube.
- 5 The display shows [bAL.] [tArA].
Re-zero the balance.
- 6 Press the key "START/STOP".
The display shows [tM] [xxx].
The pump delivers a volume of 15 ml by a rate of 250 ml/h.
- 7 The display shows [bAL.] [12.75].
Enter the value of the balance into the pump e.g. 14.65.
- 8 Press the key "START/STOP".
The display shows e.g. [Cor.] [977].
- 9 Press the key "START/STOP".
The display shows e.g. [Set] [-2-] and an acknowledgement sound occurs.
The correction factor has been stored in the address of the choosed IV set (see point 3).
- 10 Switch the pump off.
- 11 Make a control measurement with the same settings as mentioned in point 4 using the IV-set for which the correction factor has been changed. Perform an occlusion pressure check (see chapter "Pressure sensor calibrating", point 15-19) to verify the pressure alarm level.

4.7 Calibration of the battery capacity

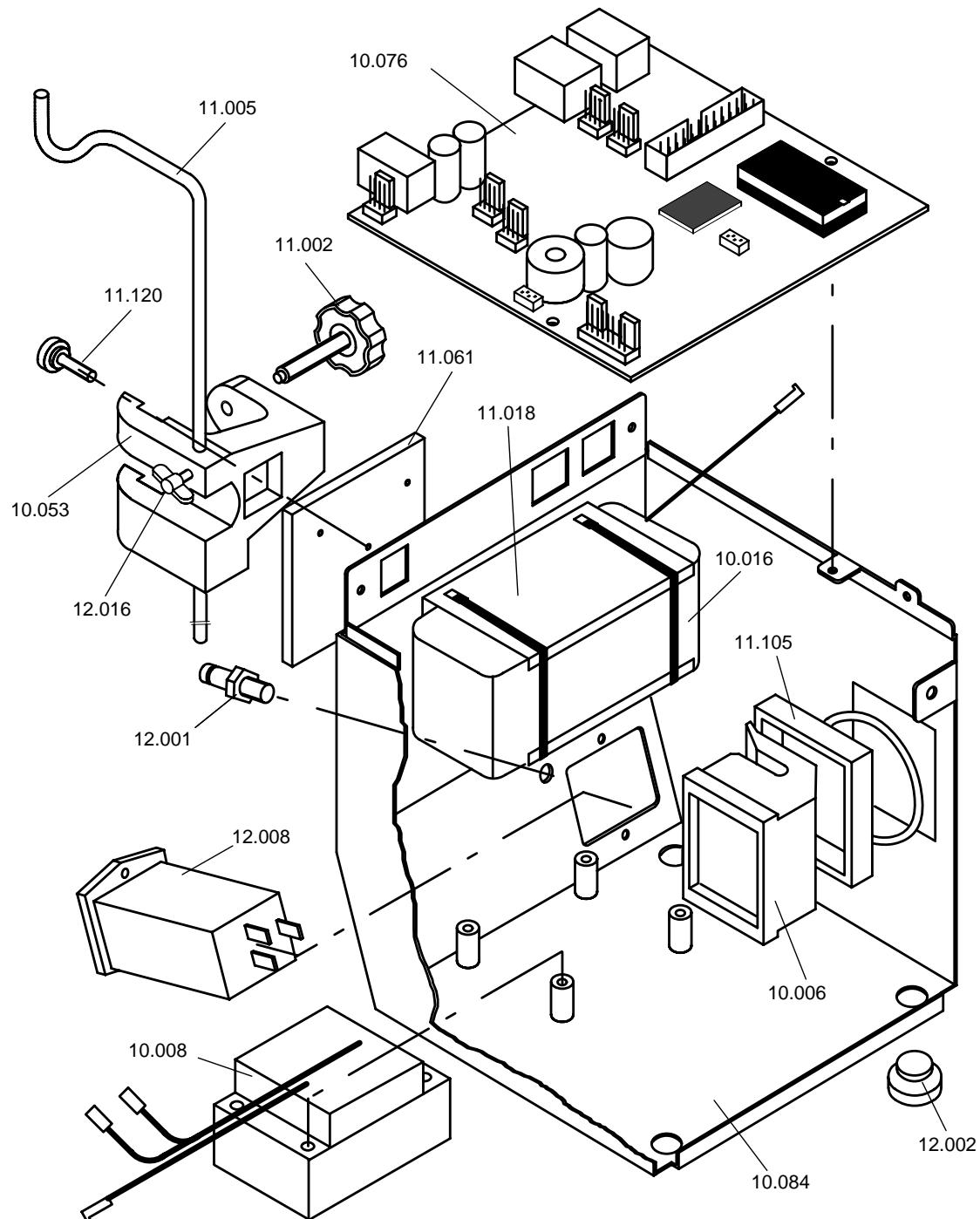
Each battery is subject to a chemical process with a slowly decreasing running time. After many charge and discharge cycles the battery may not have the capacity which provided the running time shown in the menu "CAP".

To adjust the running time of the used battery please follow the steps mentioned below:

- Go in the configuration mode of the pump.
- Select address "368" in the left display.
- Enter the data "615" in the right display and press the "START/STOP" key to accept the data. This will set the battery discharge time to the maximum of >10 hours.
- Switch the pump off.
- Be sure you have unplugged the line connection.
- Switch the pump on normally and let the pump running in battery mode until its self switching off.
- Load the battery for more than 16 hours by plug in the line.
- Switch on the pump and start an infusion with a rate of 60ml/h. The infused sum at this rate is now equal to battery operating time in minutes.
- Leave the pump running until the pump its self switching off again.
- Switch the pump on while keeping the key "1" pressed. The right display now shows the capacity of the battery in minutes. Multiply this time x 0.8 and enter the result on address "368" in the configuration mode. This time defined from now on the running time of the pump including a 15 minutes pre-alarm (only after a full charge).
- If this time is less than 4 hrs, you should replace the battery (part 10.016). If the specific time > 4hrs is not necessary, the battery has to be changed only if the time less than 3hrs, with respect to environ pollution.

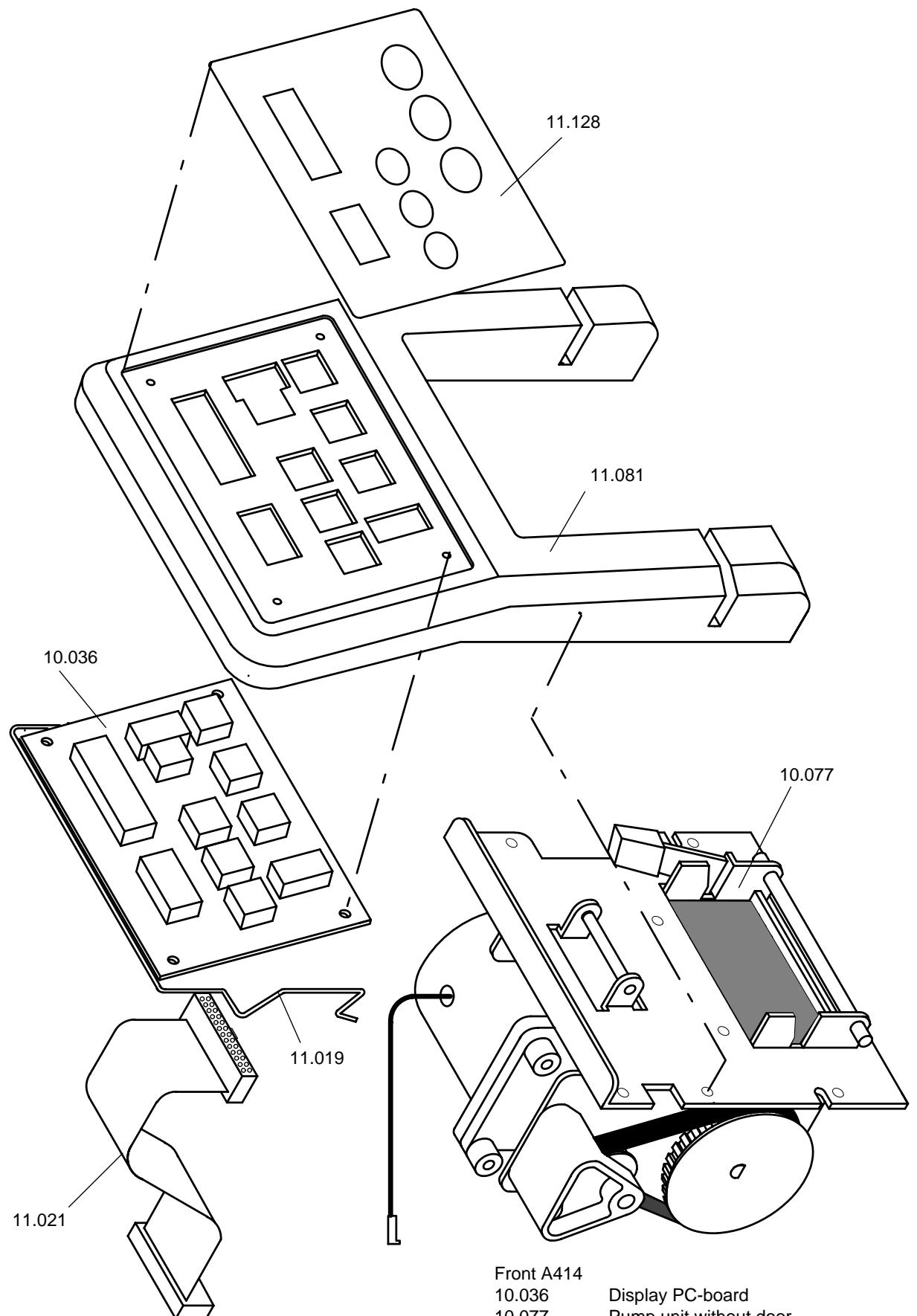
5 Safety standard check

Safety standard check	ARGUS 200	<input checked="" type="radio"/>	ARGUS Medical AG
	ARGUS 400	<input checked="" type="radio"/>	
	ARGUS 404	<input checked="" type="radio"/>	
Serial-no:	ARGUS 414	<input checked="" type="radio"/>	
Hospital/Dept./Customer:			
<p>The safety standard check has to be performed at least every 24 months or after 10000 hours of operation. The check has to be done in accordance to the operation- and service manuals.</p>			
1 Visual check for damage, cleanliness and completeness: - Housing, labels, accessories, connectors, power cable, etc. <input type="checkbox"/>			
2 Test the function of the stop flow lever: <input type="checkbox"/>			
3 Keep key "START" (ARGUS 200/400/404) or "MODE" (ARGUS 414) pressed while switching on the pump: - Display shows the software release: V - Display of 2, 4, 7, F., ml total, ml inf., h.min - Test of the red alarm LEDs: Pressure display, air, battery, drops, ALARM - Test of the green operation LEDs: Line, battery, drops, KVO <input type="checkbox"/>			
4 Place a filled tube in the air detector: - LED air alarm disappeared <input type="checkbox"/>			
5 Set rate to 111 ml/h, press "START/STOP" (without drop detector): - After 12 sec. the acoustical alarm and LED drop-alarm + LED ALARM released <input type="checkbox"/>			
6 Press key "MODE": - Acoustical alarm switches off <input type="checkbox"/>			
7 Simulate drops manually: - LED drops (green) lights up <input type="checkbox"/>			
8 Check of the occlusion-alarm-pressure: Infusion set: Codan Braun Other Pressure increase to \geq 1.1 bar? Test of the occlusion-alarm-pressure Preset level: mbar Measured: mbar <input type="checkbox"/>			
9 Check of the pump accuracy: Rate: 250 ml/h Preset volume: 25 ml Measured volume: ml <input type="checkbox"/>			
10 Test the pump at max. rate (999 ml/h): - Running smooth? <input type="checkbox"/>			
11 Battery check by setting the rate to 60 ml/h, disconnect the line and start the pump: Running time: min (If the specified typical 4hrs of operation are not required, the battery has to be changed only if the time is <3 hrs, due to environmental pollution) - Green LED battery light? - Battery prealarm after typ. 4 hrs? (Red LED battery alarm + acoustical alarm) - Battery alarm 15 min. after prealarm (Red LED battery alarm + ALARM + alarm acoustically) - After 6 min. the pump switches off <input type="checkbox"/>			
12 Charge the battery min. 16 hrs. <input type="checkbox"/>			
13 Check the external connections: - Staff alerting system <input type="checkbox"/> - External drop detector <input type="checkbox"/> - Computer interface RS232 <input type="checkbox"/>			
14 Electrical test according to EN60601-1 (all measurements made with a power cable 2,5 m) - Measurements attached <input type="checkbox"/>			
The pump has passed the safety standard check and is safe for use. <input type="checkbox"/>			
Date: Name: Signature:			<input type="checkbox"/>



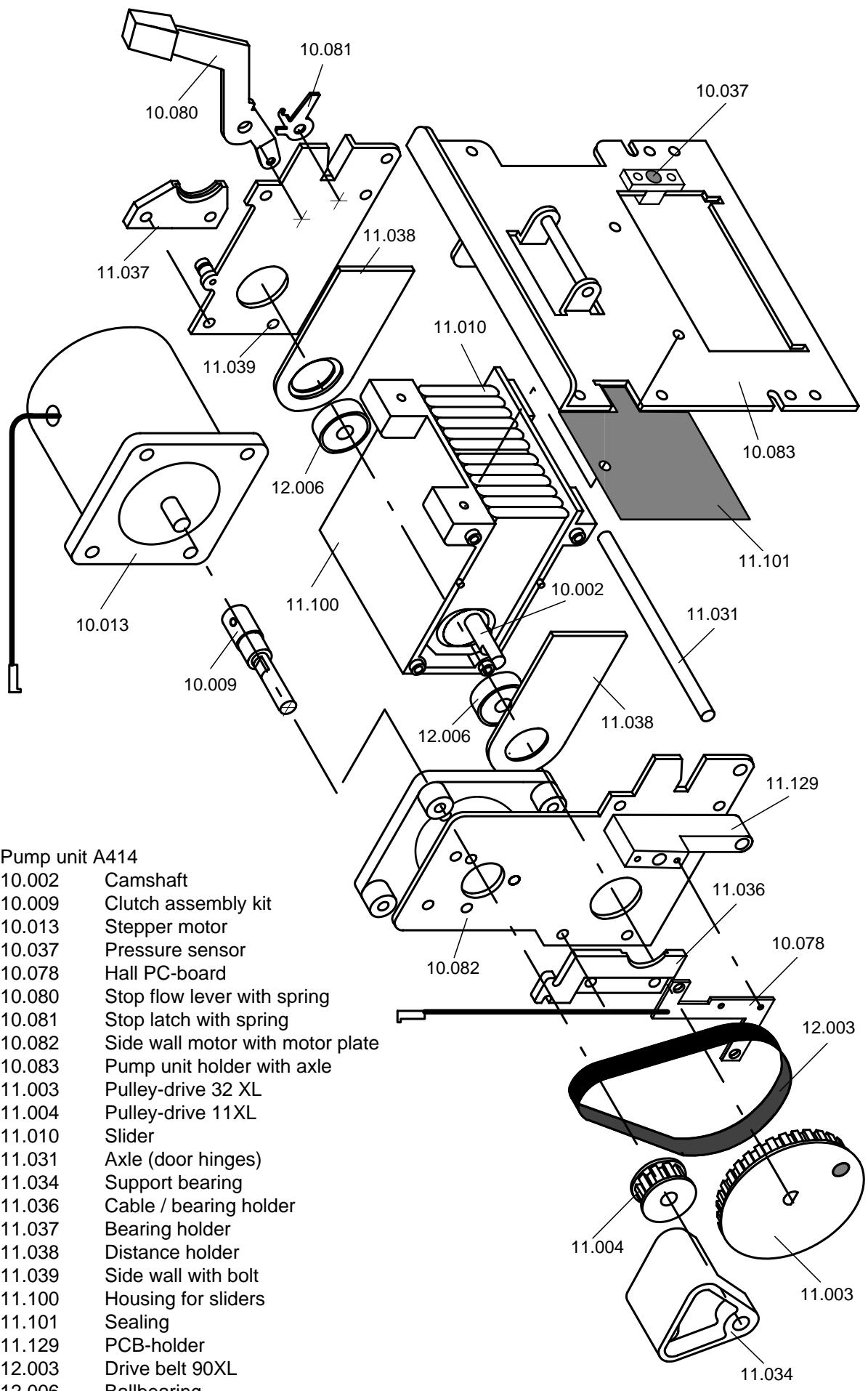
Casing A414

10.006	Air detector with O-sealing	11.105	Sealing
10.008	Transformer 230V	11.061	Clamp holder
10.016	Battery 12V/1,2Ah	11.127	Identification plate ARGUS 414
10.053	Clamp with screws	11.120	Fixing screw M5x20 black
10.076	Main board ARGUS 414	12.001	Equipotential plug
10.084	Casing with rubber foot	12.007	Cable staff alert (opt.)
11.002	Spindle for pole clamp	12.008	Mains plug with filter
11.005	Bottle holder 450mm	12.011	RS 232 cable
10.084	Casing with rubber foot	12.012	RS 232 adapter
11.018	Battery holder	12.016	Srew for bottle holder



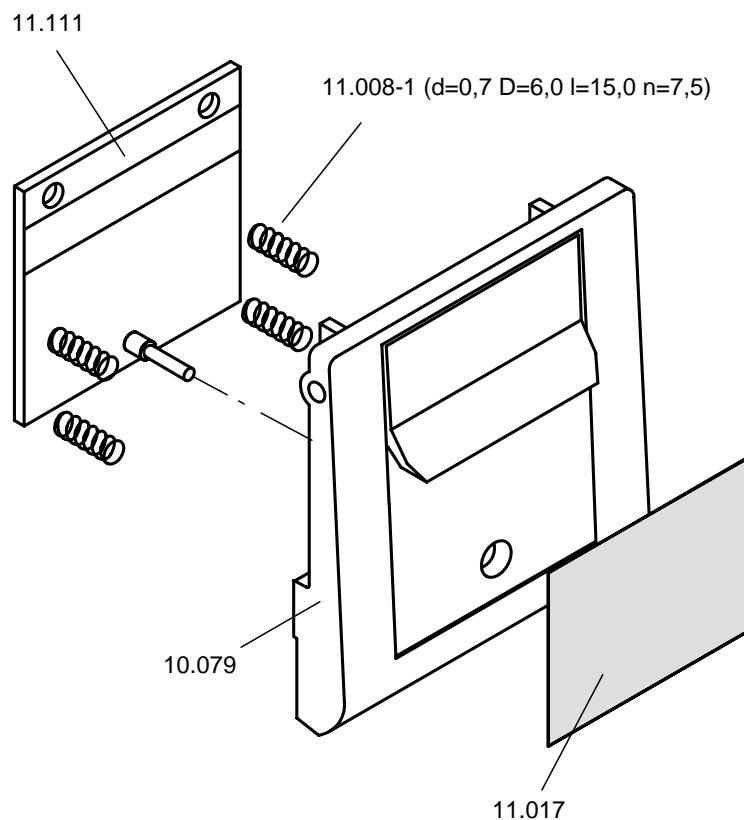
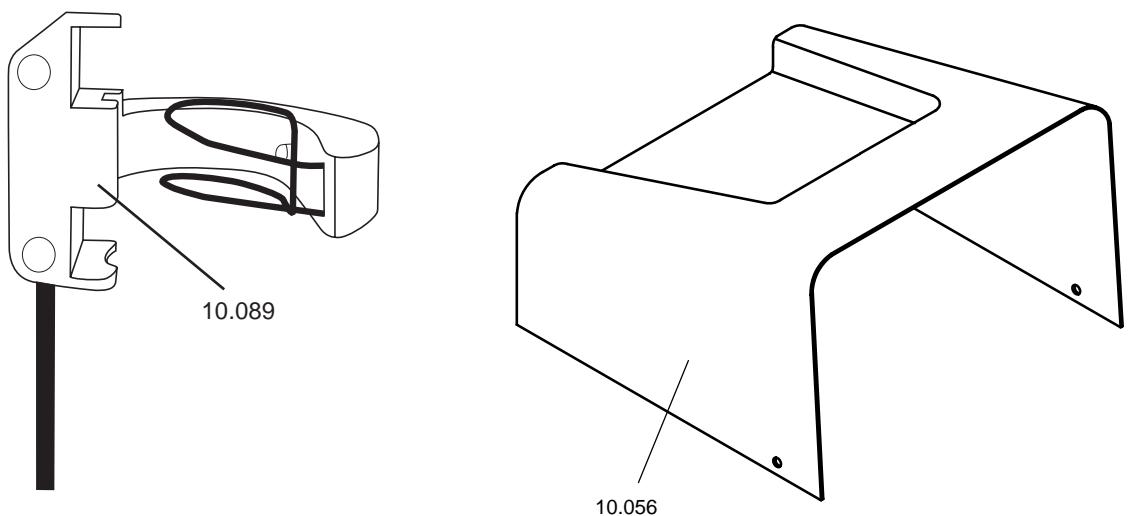
Front A414

10.036	Display PC-board
10.077	Pump unit without door
11.019	Spring (Front-housing)
11.021	Cable assy 26pol
11.081	Front PVC
11.128	Frontpanel A414



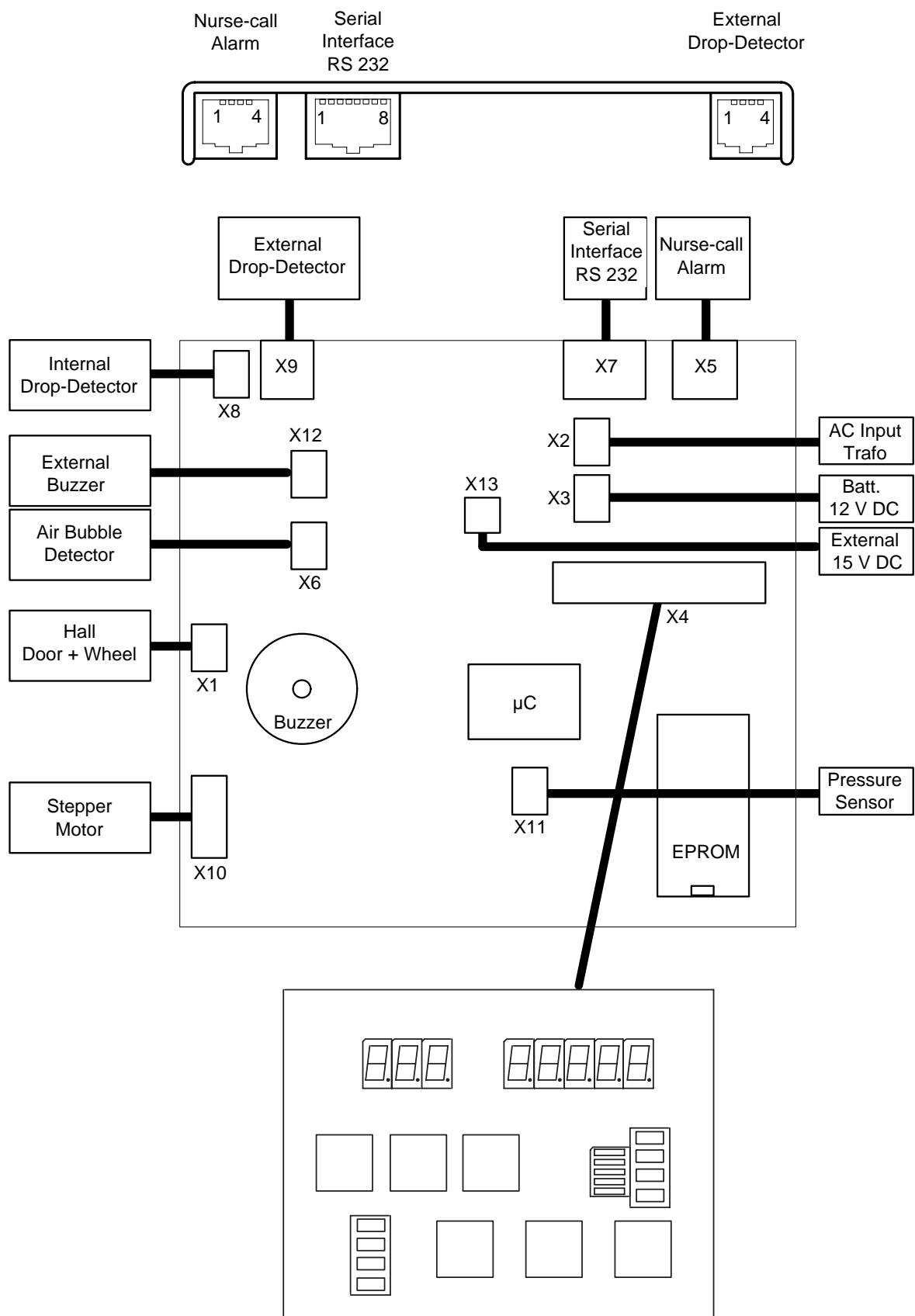
Pump unit A414

- 10.002 Camshaft
- 10.009 Clutch assembly kit
- 10.013 Stepper motor
- 10.037 Pressure sensor
- 10.078 Hall PC-board
- 10.080 Stop flow lever with spring
- 10.081 Stop latch with spring
- 10.082 Side wall motor with motor plate
- 10.083 Pump unit holder with axle
- 11.003 Pulley-drive 32 XL
- 11.004 Pulley-drive 11XL
- 11.010 Slider
- 11.031 Axle (door hinges)
- 11.034 Support bearing
- 11.036 Cable / bearing holder
- 11.037 Bearing holder
- 11.038 Distance holder
- 11.039 Side wall with bolt
- 11.100 Housing for sliders
- 11.101 Sealing
- 11.129 PCB-holder
- 12.003 Drive belt 90XL
- 12.006 Ballbearing

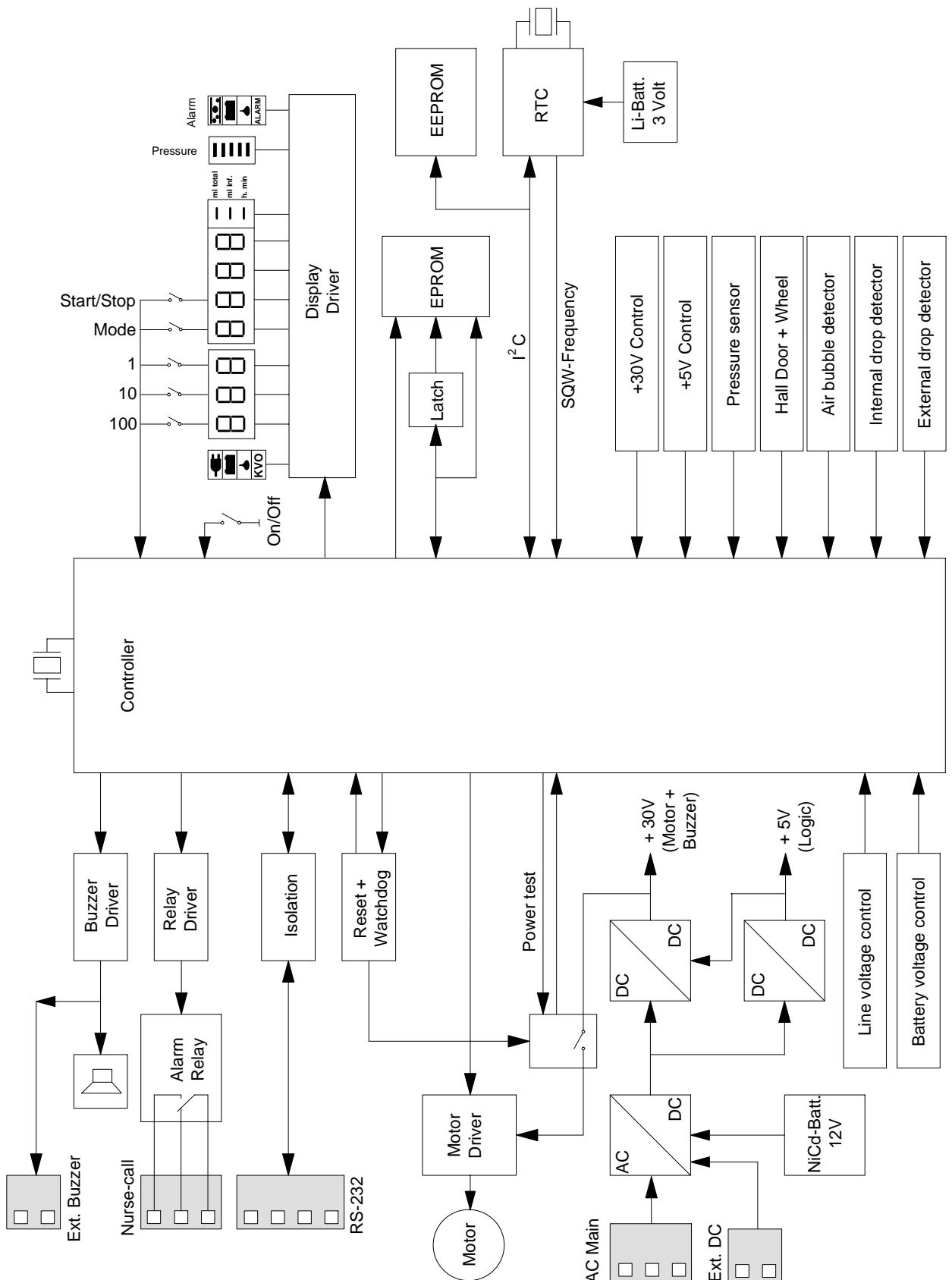


Cover and Door A414

10.056	Cover with magnet
10.050	Door complet
10.079	Door with handle
10.089	External drop detector 01
11.008-1	Pressure spring no. 1
11.017	Door cover
11.111	Counter plate



Wiring diagram



Bloc schematic